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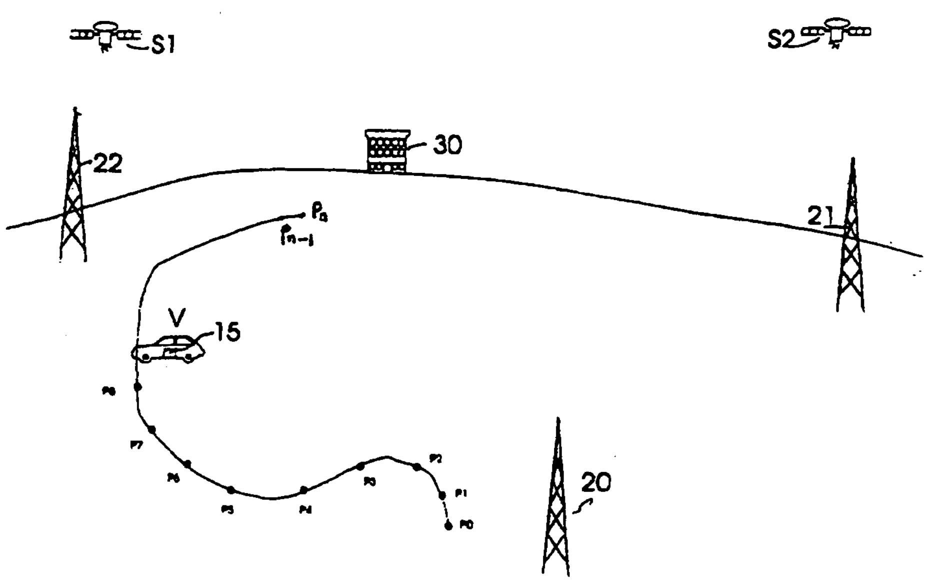

(57) Abstract

A system and method for determining the distance travelled by a vehicle is disclosed to enable a charge to be rendered for roadway usage. Vehicles V are fitted with a controller (15) which includes a global positioning system (40), a control unit (42) and a radio packet modem (44) conditioning data received by the global positioning system (40) enables the positioning signal to be produced at predetermined time periods and the control unit (42) processes that information to either calculate distance travelled data or simply transmits the process information to towers (20, 21, 22) for in turn transmission to a monitoring station (30) to enable the distance measurement to be determined so that charges can be levied to the owner of the vehicle concerning the road usage.

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SYSTEM AND METHOD FOR DETERMINING THE DISTANCE TRAVELLED BY A VEHICLE

This invention relates to a system and method for determining the distance travelled by a vehicle to enable, for example, but not exclusively, a vehicle owner to be charged for the use of roadways having regard to the distance travelled by the vehicle on the roadways.

User pay philosophy for the use of public resources is becoming more popular whereby users pay for the resource as it is used. Privatisation of some public resources such as energy provision facilities and the like are becoming popular in a number of countries. The possibility of improving road systems and the like by either privatisation of the road systems or a user pay system requires the ability to monitor vehicles to determine the usage of roadways made by the vehicle so that appropriate charges can be levied.

At present, no suitable systems exist for billing for the use of any and all roads within a country or province. One conventional method in existence for enabling payment by users of roadways and the like is toll systems whereby a user pays a toll at tollgates on the roadway. Whilst these systems do enable the collection of money from users, they do so only on the basis that the user pay as a toll gate is passed and not on a basis having regard to the actual distance travelled or use made of roadways in a roadway network. Non-tollgate systems do exist to some extent but they are restricted in their size and the road coverage they provide.

The object of this invention is to provide a method and system which can enable the distance travelled by a vehicle to be determined so that a vehicle owner can be billed having regard to the use made of a roadway based on the

distance travelled by the vehicle.

The invention, in a first aspect, may be said to reside in a system for determining the distance travelled by a vehicle, including:

means for determining the position of the vehicle at predetermined time periods; and

processing means for providing an indication of the distance travelled from the positions of the vehicle as determined by the detecting means.

Since the distance travelled by the vehicle can therefore be determined, a charge can be levied to the owner of the vehicle based on the distance travelled. Furthermore, the system is a remote system which can monitor the distance travelled by the vehicle to thereby enable a charge to be levied without requiring input from the vehicle owner.

Preferably the means for detecting comprises a unit for mounting on a vehicle for receiving positional signals to enable the position of the vehicle to be determined by the unit and wherein the unit also includes the processing means for determining the distance travelled and wherein the unit outputs a reference signal relating to the vehicle to identify the vehicle and distance data relating to the distance travelled by the vehicle for receipt by a control facility to enable billing information to be compiled.

Preferably the positional signals are produced by a plurality of transmitting means.

The transmitting means can be a satellite global positioning system for determining the position of the vehicle at predetermined time intervals or land based transmitters.

The invention, in a second aspect, may be said to reside in a method for determining the distance travelled by a vehicle including the steps of:

detecting the position of the vehicle at predetermined time periods; and

determining from the positions of the vehicle at the predetermined timed periods the distance travelled by the vehicle.

The present invention also provides a system for billing for road usage by a vehicle, including:

a controller for mounting on a vehicle, the controller having;

i) positioning means for providing positioning data relating to the position of the vehicle;

ii) a control unit for controlling supply of the positioning data;

iii) a wireless transmission means for transmitting the positioning data and a vehicle identification code under the control of the control unit; and

remote monitoring means for receiving the positioning data and the identification code transmitted from the wireless transmission means and for providing billing information based on the positioning data.

The present invention also provides a method for billing for road usage by a vehicle, including the steps of:

mounting a controller onto a vehicle, the controller having;

i) a positioning means for providing positioning data relating to the position of the vehicle;

ii) a control unit for controlling supply of the positioning data;

iii) a wireless transmission means for transmitting the positioning data and a vehicle

identification code under the control of the control unit;

causing the wireless transmission means to transmit the positioning data and vehicle identification data to a remote monitoring means;

determining billing information based on the positioning data for producing a bill for dispatch to a user of the vehicle.

A preferred embodiment of the invention will be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a diagram illustrating the preferred embodiment of the invention;

Figure 2 is a block diagram of a controller used in the preferred embodiment of the invention;

Figure 3 is a circuit diagram apart of the controller of Figure 2; and

Figure 4 and Figure 5 are flow charts illustrating operation of the preferred embodiment of the invention.

With reference to Figure 1, a road is schematically shown by the dotted line 10. Data transmission land based towers covering the geographical area to be monitored are numbered 20, 21 and 22. The vehicle, which is identified as V, contains a controller 15 including a radio packet modem with a globally unique serial number, a GPS unit and a control unit. The satellites S1 and S2 represent the geostationary satellites used by the GPS system to determine position. The secure monitoring station 30 collects the data received from the vehicle via the towers. The dots labelled P0, P1, ..., P8 indicate the positions of the vehicle at the time of position determination.

The GPS system shall provide an accurate global position for the unit. This position along with the last position

read from the GPS shall be used to determine the distance travelled. Note this calculated distance is an approximation of the actual distance travelled, the shorter the time between the sampling of position shall provide a more accurate calculation of the distance travelled. The distance travelled shall be stored in the control unit in the vehicle.

The vehicle may send the record of distance travelled to the tower at any time during the journey or on completion of the journey. Contained in the data sent to the tower would be the unique identification number from the modem which would be used to uniquely identify the vehicle. Also contained in the message could be the global position which would allow for tracking of the vehicle.

The journey illustrated in the diagram may take the vehicle through various road types. These road types may incur varied tariff charges. By use of localised transmitters in the road the control unit in the vehicle could keep a tally of the distance travelled on the various grades of road. The use of such a system could be enhanced to make the in-road transmitter change the identification signals to adjust for peak-time and other times of high usage, or to cover the cost of initial construction costs. This system would also cover the case of travel on unsealed roads where a tariff would not be applicable.

Another extension to the system could be the inclusion of a "Smart card" reader in the vehicle which requires the driver to insert their driving licence into the unit. This driving licence would be in the form of a "Smart card" which would contain all the details normally held on a driving licence. This driver information could be transmitted in the packet to the tower to identify the driver of the vehicle. The spin-off provided by the use of this "Smart card" system would be the restriction of usage

of the vehicle to authorised persons, or the limitation of performance of the vehicle for young drivers.

By the use of GPS and localised distance travelled calculations it would be possible for a system to handle a greater number of vehicles as the total number of over-air transactions would be reduced. Should it be necessary to track a single vehicle it would be possible to repeatedly "poll" the vehicle. The returned data message would then be used to track the location.

Identification of the vehicle by logical association with the identification number in the controller 15 would be easily handled in the secure monitoring station and would therefore cater for the case of servicing or replacement of the controller 15.

Thus, the controller 15 continuously outputs a reference signal which includes identifying data identifying the vehicle and also data relating to the distance travelled by the vehicle which is determined from the positional information determined by the controller 15 from the satellites. The identifying data may be the vehicle registration number or any other such data which can identify the vehicle to enable an account for road usage to be forwarded to the owner of the vehicle indicative of the distance the vehicle has travelled on the road system.

The data is received by one or more of the towers 20 to 22 and transmitted by the towers 20 to 22 to a remote location such as a security location such as at station 30 where billing information can be compiled for forwarding to a user. The position of the vehicle may be determined by the controller 15 at predetermined time periods of, for example, 1 second, 10 seconds or the like depending on the sensitivity of the system and the time taken to make a positional fix of the vehicle.

When the vehicle is not in use (ie the ignition is switched off), the controller 15 is in standby mode so receipt of positioning information and communication with the station 30 is still possible. The controller 15 is switched to active mode when the vehicle ignition is turned on. Thus, when the vehicle is started, the unit begins determination of positional information and outputs the identifying data and positioning or distance data according to a predetermined time period protocol or as requested by the station 30. The signal outputted from the vehicle V is detected by the towers 20, 21 and 22 or station 30. When the towers 20, 21 and 22 receive the signal from the vehicle V they transmit that information to the host station 30. The position of the vehicle V is determined at predetermined time periods which may be as small as periods of one second or less so that positional information relating to the vehicle as the vehicle travels on the roadway is continuously provided.

For example, with reference to Figure 1, at time period 0 the position of the vehicle V may be determined at position P0 shown in Figure 1 at the commencement of its journey from place P0 to place Pn in Figure 1. At time period 1 second, the position might be at position P1, at time period 2 seconds, the position might be at P2 and at time period n seconds, the position might be at Pn at the end of the journey as shown in Figure 1.

The controller 15 carried by the vehicle can determine distance travelled in a processor 50 (see Figure 3) from the positional signals transmitted by satellite S1 and S2 and provided the positioning system 40 (see Figure 2) by determining the distance between the positions P0, P1, P2 determined for the vehicle from time to time so that the total distance travelled by the vehicle from the position P0 to position Pn can be calculated. The information concerning distance travelled is transmitted to the towers

20 to 22 and then to station 30. A charge can then be rendered for the use of the roadway based on the distance travelled by the vehicle each time the vehicle is used and at the end of a predetermined accounting period such as at the end of each month, a bill can be sent to the owner of the vehicle for road usage based on the distance the vehicle has travelled on the road system.

Since the preferred embodiment of the invention enables the position of vehicles to be determined in small incremental time periods an accurate distance measurement can be built up. Furthermore, the system can be used to trace stolen vehicles, missing vehicles and also to enable the whereabouts of vehicles in a fleet of vehicles such as a taxi fleet to be determined. Other information relating to the vehicle can also be transmitted from the units in the vehicle to enable additional information to be provided to the owner concerning the state of the vehicle, the need for service and the like.

Figure 2 is a block diagram of the controller 15 referred to in Figure 1. The controller 15 includes a global positioning system 40 which receives signals from the satellites S1 and S2 and outputs GPS data to a control unit 42. The control unit 42 processes the data and outputs signals to a radio packet modem 44 which transmits the data over the air (that is by wireless transmission) to the towers 20, 21 and 22 which in turn transmits the information to the monitoring station 30. The controller 15 may include other units such as a unit 46 which is coupled to the control unit 42 for supplying additional data such as electronic street directory data or the like.

The global positioning system 40 and the radio packet modem 44 are well known and therefore will not be described in further detail. Although the preferred embodiment uses a radio packet modem for wireless transmission of data other

wireless transmission systems or devices could be used such as CDPD technology. The control unit 42 is more fully described with reference to Figure 3.

Referring to Figure 3, the control unit 42 includes a processor 50 (such as a DS5002 made by Dallas semiconductors). The processor 50 is powered by a power supply 52 which receives primary power from a vehicle battery 54. A back up battery 56 may be included in the power supply in the event that the vehicle battery 54 is disconnected or becomes inoperative. The power supply 52 includes a transistor 54′ which acts as an amplifier to provide a signal to the processor 50 to show that the power supply is activated and that power is actually being supplied. If power supply is deactivated by disconnecting the battery 54 or tampering with the back up battery 56 with a view to overriding the system so that the system does not operate to transmit data to the monitoring station 30, the power failure will be detected by the output from the transistor 54′ on-line 56 so that the processor 50 is alerted to an unauthorised disruption of power supply. The processor 50 may then cause an appropriate signal to be transmitted for detection by the towers 20, 21, 22 and for transmission to the monitoring station 30 to indicate that tampering has taken place. In the event of authorised disruption to the power supply in the event of servicing or the like, a key pad (not shown) may be included for inputting an appropriate authorisation key code which can be detected by the processor 50 to indicate that an authorised disruption of power is taking place so that the aforementioned signal is not transmitted to the monitoring station 30, or alternatively an authorisation disconnect signal is transmitted to the monitoring station 30 so that the monitoring station 30 can determine that an authorised disruption to power supply has occurred and maintain a ledger of such disruptions for security purposes to ensure that an authorised code is not being misused.

The processor 50 is connected to a connector 60 which connects to the global positioning system 40 for providing data from the system 40 to the microprocessor 50 via a serial interface chip 62 (such as a Zilog 285C30SCC-10). Thus, data from the global positioning system 40 is provided from the connector 60 to the serial interface chip 62 and then to the processor 60 on bus 64. The bus 64 is also connected to a non-volatile random access memory 66 and to a programmable read only memory 68. The memory 66 temporarily stores data which, may from time to time, be transmitted to the towers 20, 21 and 22 and then to the monitoring station 30 and the read only memory 68 contains programming instructions and the like for operation of the processor 50.

The processor 50 is also coupled to the serial interface chip 62 by a bus 70 which, in turn, is connected to the random access memory 66 and the read only memory 68. The serial interface chip 62 is connected to a connector 74 which in turn connects to the radio packet modem 44 so that output data can be supplied to the modem 44 for transmission to the towers 20, 21 and 22. The processor 50 has an oscillator 76 for clocking the processor 50.

Line 80 is connected to the read write port 79 of the processor 50 and also to the read write port of the memory 66 and read write ports 81, 83 of the interface 62 to determine whether data is being written to the memory 66 or read from the memory 66 and to determine whether the serial interface 62 is transmitting data to or from the connector 60 or to or from the connector 74. The read port 79 is connected direct to the read port 81 of the interface 62 and via an inverter 87 to the write port 83 of the interface 62. Thus, by varying the level of the signal from port 79, the interface will either "read" information from connector 60 or 74 or "write" information to connector 60 or 74.

A bank select circuit 78 is also connected to the bank select port 90 of the processor 50 so that a high or low output from the port 90 can be used to select either the memory 66 or the memory 68. The CE output 93 of the processor is connected to a buffer 95 by line 97 and then to the CE input of memory 66 by line 82. The CEIN port 99 of the processor 50 is connected to a buffer 101 by line 103. The port 90 (as shown by reference 90′ in Figure 3) is connected direct to buffer 95 and to the buffer 101 by an inverter 96 so the signal from port 90 will be high for one of the buffers and low for the other. For example, if port 90 is high memory 68 is active as the signal to buffer 101 is low and therefore buffer 101 is enable allowing the chip enable signal on-line 103 to be provided to memory 68. If the signal at port 90 is low memory 66 is active as the signal to buffer 95 is low enable the chip enable signal on-line 97 to be provided to memory 66. Thus, by changing the level of the signal at port 90 it is possible for the processor to switch between the memories 66 and 68.

A power supply in the form of a battery 100 is also provided and coupled to the processor 50 on-line 104 and to the connector 60 to power the global positioning system 40. A crystal oscillator 106 is also coupled to the serial interface chip 62 for clocking the serial interface chip 62.

An expansion bus 110 is connected to a connector 112 which may connect to other electronic modules such as the module 46 shown in Figure 2 which may supply electronic street directory data or any other data which could be used by the system. The bus 110 connects with a chip 114 (such as a Maxim MAX232) which adjusts signal levels from the data supplied on the bus 110 for use by the processor 50. Condition elements such as diodes 113 and resistors 115 may also be included for conditioning signals supplied from connector 112 to processor 50.

Thus, positional data received from the global positioning system 40 is processed by the unit 42 so that position signals received from time to time, from for example every 1 second to every 30 seconds or the like, may be converted by the processor 50 into distance measurements so that the relevant data can be supplied via the connector 74 to the radio pocket modem 44 for transmission to the towers 20, 21, 22 and then for transmission to the monitoring station 30 so that the appropriate distance travelled can be calculated and the appropriate bill prepared and dispatched.

Alternatively, the raw data could be transmitted to the monitoring station 30 where the raw data is converted into distances at the monitoring station 30 for the preparation of an appropriate bill and dispatch of that bill.

Figure 4 is a flow chart illustrating operation of the controller 15. The microprocessor 50 which receives a time-stamped position information packet from the global positioning system 40 via the connector 60 and serial interface 62 at predetermined time intervals of once per X seconds (where X is a whole integer between, and inclusive of, the values of 1 and 60, which value may be altered by the microprocessor 50) (step 401). In the off-line mode (402) the microprocessor 50 causes the information packet to be stored in the random access memory 66 (step 403) and may also be sent to external components (not shown) via the bus 110 and connector 112.

The microprocessor 50 may perform certain mathematical manipulations (404) on the data received from the global positioning system 40 during the interval between the delivery of the packets of positional data to increase the accuracy of the positioning information.

The positional data which is received by the processor 50 and step 401, also has assigned to it a unique vehicle identification code so that the code together with the data is processed and transmitted as will be described hereinafter so that the data can be identified with the particular vehicle involved for compilation of a bill.

The microprocessor 50 will continue to store the positional information in the random access memory 66 until either a predetermined time (step 405) is reached or a message is received from the monitoring station 30 when the predetermined time period has elapsed, or a request message is received from the monitoring station 30 (step 406). The information stored in the random access memory and vehicle identification code is transmitted to the monitoring station 30 (step 407) by the radio packet modem 44 via the communication towers 20, 21 and 22 shown in Figure 1.

In an on-line mode (408) of the device, the monitoring station 30 can issue a signal direct to the controller 15 for on-line dispatch of data. In this mode, the microprocessor 50 is receiving the time-stamped position information as described above. However, in this mode, the data is directly transmitted in real-time (step 409) via the radio packet modem 44 to the monitoring station 30. The data may also be supplied to an external device as described above and in this mode the data may also be stored in the random access memory 62 and processed as described above to ensure that data is not lost during transmission.

In the on-line mode, the stationary monitoring system 30 may use the real time positioning information which is transmitted to it from the controller 15 for tracking a vehicle or assessment of traffic conditions.

With reference to Figure 5, which shows a flow chart of the operation of the monitoring station 30, in the off-line mode (410), the host receives the data and vehicle identification code from the radio packet modem 44 (step 411) which is transmitted at the predetermined time interval or upon receipt of a message from the monitoring station 30. All of the control units in the system would obviously not transmit information at the one time and just may exceed the capabilities of both the monitoring station and the communications infrastructure. The monitoring station 30 may communicate to any controller 15 associated with a vehicle at any time. Once the data store of positioning information from a certain controller 15 has been received, it is then processed (step 412) with respect to the time and position information that it contains. The monitoring station 30 has access to a digital map which assigns monetary values to regions according to their location and the time at which the location information was stored. Thus, the host may build up a dollar amount (step 413) for road usage according to the number of kilometres travelled in a particular area, with the time of the travel being an important factor in the assessment (a greater value is assigned to certain areas in peak time). The resolution of this map is independent of the functionality of the monitoring station 30 ie regions could be as general as CBD, suburban and country areas or as specific as to incorporate different roads and transit routes. As well as road (or area) usage, the monitoring station may incorporate secondary billing information which might include speeding and unauthorised parking etc. Once the billing information has been compiled, the monitoring station then forwards it to the billing authority (step 414) where it is dispatched to the owner of the vehicle associated with the controller 15.

In the on-line mode (415) where the monitoring station 30 has sent a specific request to a unit 15, the unit 15 will

begin to transmit its time-stamped position information immediately to the monitoring station 30 upon receipt of that information from the global positioning device 40. The monitoring station may then indicate this unit's position (step 416) upon a display device in real time. This information may be used for the purposes that may include (but not limited to) tracking of stolen vehicles, traffic congestion information, dispatch and location of essential services such as police and ambulance.

Since modifications within the spirit and scope of the invention may readily be effected by persons skilled within the art, it is to be understood that this invention is not limited to the particular embodiments described by way of example hereinabove.

CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A system for determining the distance travelled by a vehicle, including:

means for determining the position of the vehicle at predetermined time periods; and

processing means for providing an indication of the distance travelled from the positions of the vehicle as determined by the detecting means.

2. The system of claim 1 where the means for detecting comprises a unit for mounting on a vehicle for receiving positional signals to enable the position of the vehicle to be determined by the unit and wherein the unit also includes the processing means for determining the distance travelled and wherein the unit outputs a reference signal relating to the vehicle to identify the vehicle and distance data relating to the distance travelled by the vehicle for receipt by a control facility to enable billing information to be compiled.

3. The system of claim 2 wherein the unit includes a global positioning system for providing positional signals to the processing means for determining the distance travelled and wherein the processing means is coupled to a radio packet modem for wireless transmission of the distance data and reference signal to the control facility to enable billing information to be compiled.

4. The system according to claim 1 wherein the means for determining comprises a global positioning system for providing positional data and primary processing means for supplying data to an output means for output of positioning data and wherein the processing means is a computer at a remote location which receives the positioning data transmitted from the output means and provides an indication of the distance travelled at the remote location

from the positioning data to enable billing information to be compiled.

5. The system according to claim 1 wherein the means for determining comprises a global positioning system and the processing means comprises:

a processor for receiving information from the global positioning system to enable distance data to be determined, the process of being coupled to output transmitting means so that the distance data can be supplied to the output transmitting means for wireless transmission to a remote location to enable billing information to be compiled at the remote location.

6. The system of claim 5 wherein the processing means further includes a read only memory for controlling the processor and a random access memory for temporary storage of data.

7. The system according to claim 1 further including means for detecting unauthorised disruption of power to the system.

8. The system of claim 2 where the positional signals and produced by a plurality of transmitting means.

9. A system for billing for road usage by a vehicle, including:

a controller for mounting on a vehicle, the controller having;

i) positioning means for providing positioning data relating to the position of the vehicle;

ii) a control unit for controlling supply of the positioning data;

iii) a wireless transmission means for transmitting the positioning data and a vehicle identification code under the control of the

control unit; and

remote monitoring means for receiving the positioning data and the identification code transmitted from the wireless transmission means and for providing billing information based on the positioning data.

10. The system according to claim 9 wherein the positioning data includes position data of the vehicle at predetermined time periods and the monitoring means calculates a distance travelled by the vehicle from the position data at the predetermined time periods.

11. The system according to claim 11 wherein the remote monitoring means produces accounts for dispatch to a road user relating to use of the vehicle on the roadway.

12. The system according to claim 10 wherein the remote monitoring means transmits the distance travelled information to an authority for compilation of a bill for dispatch to a user relating to use of the vehicle on the roadway.

13. The system according to claim 9 wherein the wireless transmission means comprises a radio packet modem.

14. The system according to claim 9 wherein the positioning means comprises a global positioning system.

15. The system according to claim 9 wherein the control unit includes a microprocessor for controlling the positioning means and the wireless transmission means together with the supply of positioning data and the vehicle identification code to the wireless transmission means.

16. The system according to claim 14 wherein the remote monitoring means comprises a computer at a

monitoring station.

17. The system according to claim 9 further including intermediate transmission systems for receiving the positioning data and vehicle identification code from the wireless transmission means and for relaying that data and code to the remote monitoring means.

18. The system according to claim 9 wherein the positioning information received by the remote monitoring means enables tracking of a vehicle and location of a vehicle for emergency purposes or vehicle recovery purposes.

19. A method for determining the distance travelled by a vehicle including the steps of:

detecting the position of the vehicle at predetermined time periods; and

determining from the positions of the vehicle at the predetermined timed periods the distance travelled by the vehicle.

20. The method according to claim 19 wherein the determined distance travelled is used to compile billing information concerning road usage for dispatch to a user of the vehicle.

21. A method for billing for road usage by a vehicle, including the steps of:

mounting a controller onto a vehicle, the controller having;

i) a positioning means for providing positioning data relating to the position of the vehicle;

ii) a control unit for controlling supply of the positioning data;

iii) a wireless transmission means for

transmitting the positioning data and a vehicle identification code under the control of the control unit;

causing the wireless transmission means to transmit the positioning data and vehicle identification data to a remote monitoring means;

determining billing information based on the positioning data for producing a bill for dispatch to a user of the vehicle.

22. The method according to claim 21 wherein the remote monitoring means produces the bill and dispatches the bill to the user.

23. The method according to claimed 21 wherein the remote monitoring means provides the billing information to an authority for preparation of an account for dispatch to the user.

24. The method according to claim 23 wherein the positioning data includes position data of the vehicle at predetermined time periods so that a distance travelled by the vehicle can be calculated from the position data to enable the billing information to be compiled.

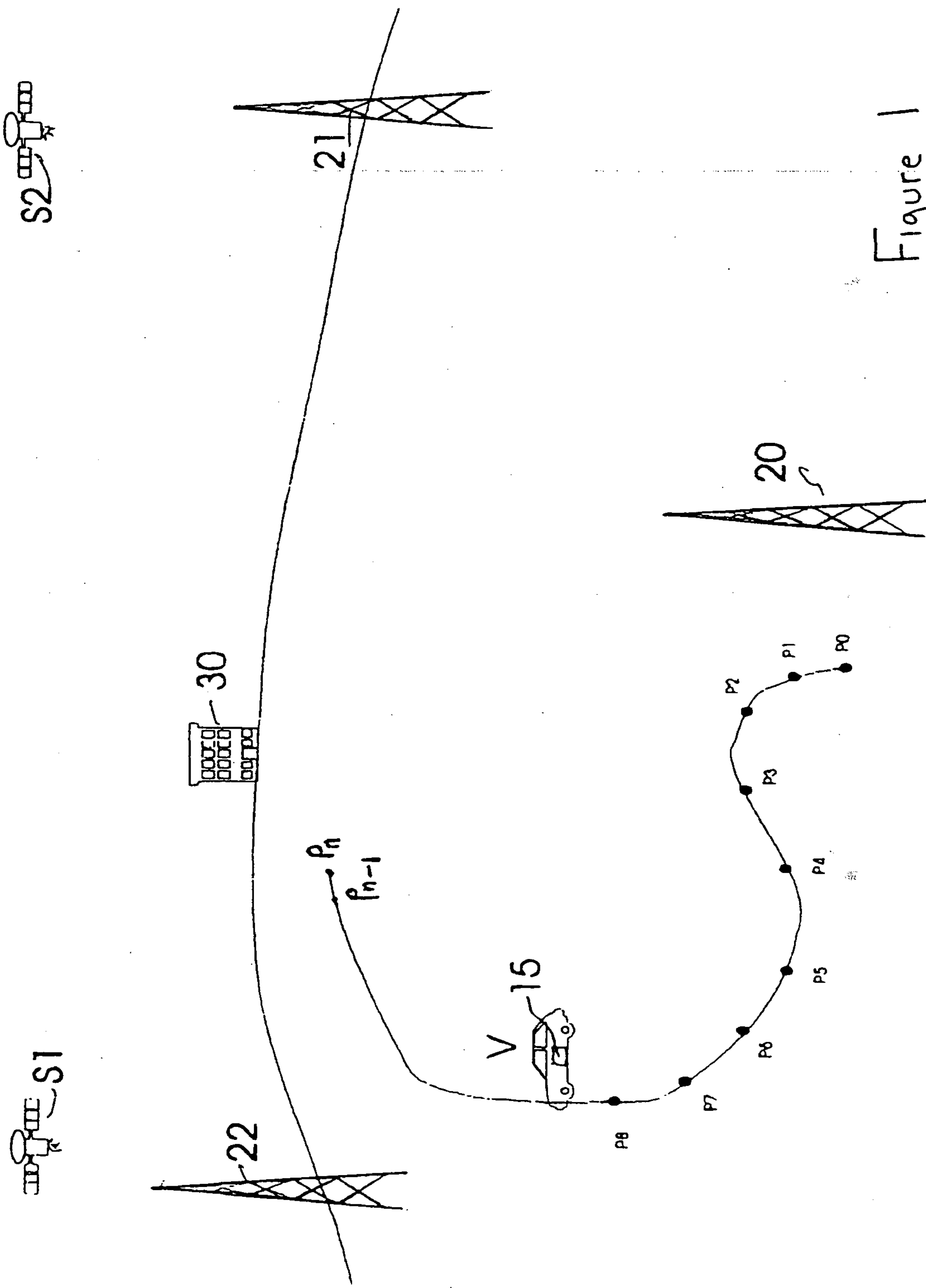

Figure 1

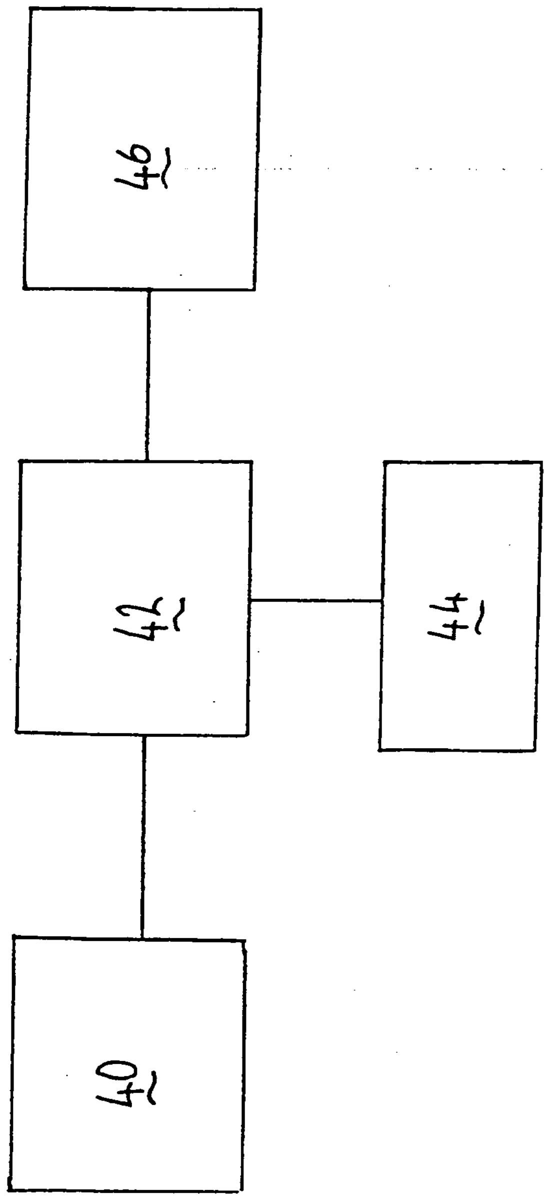

Figure 2

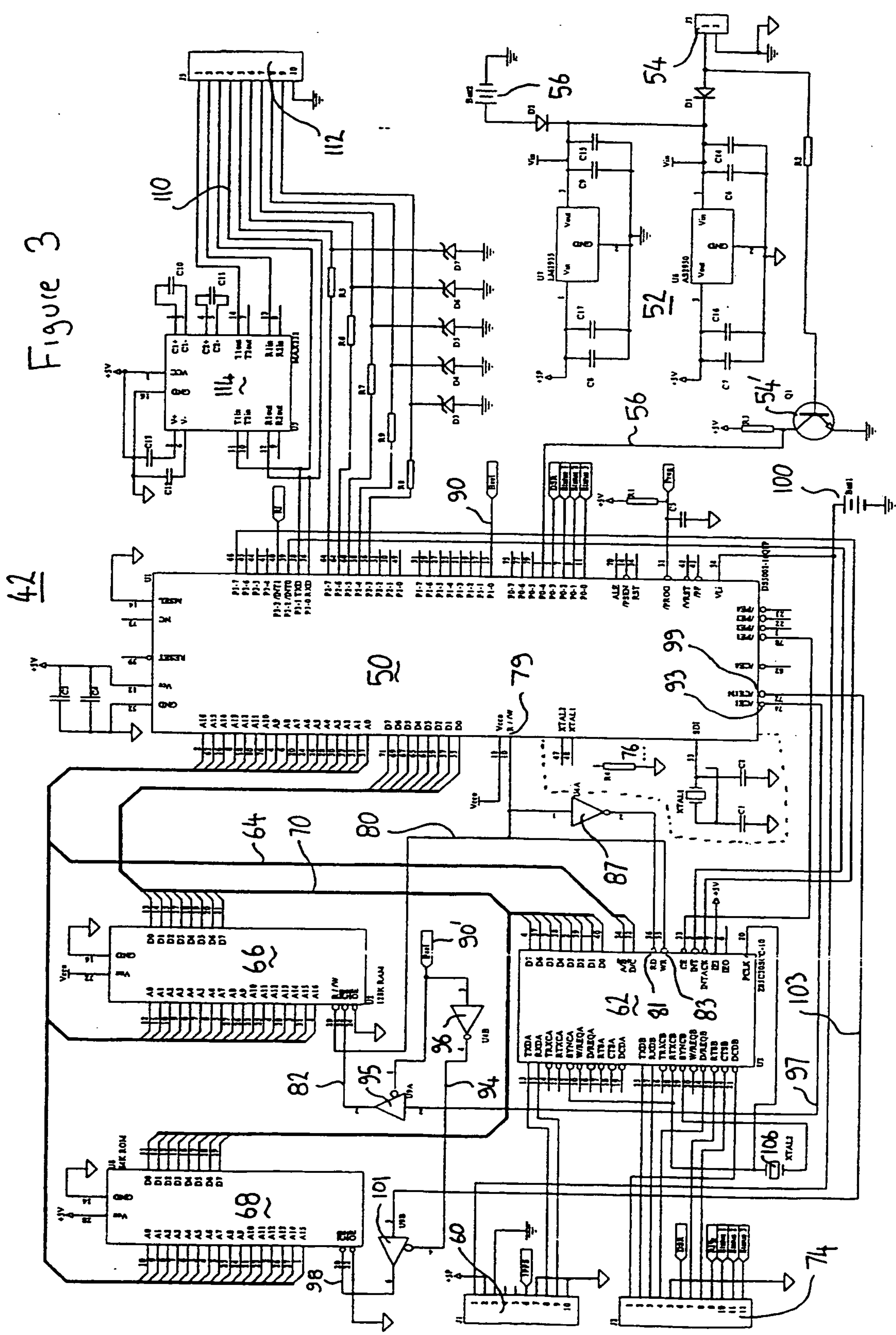

Figure 3

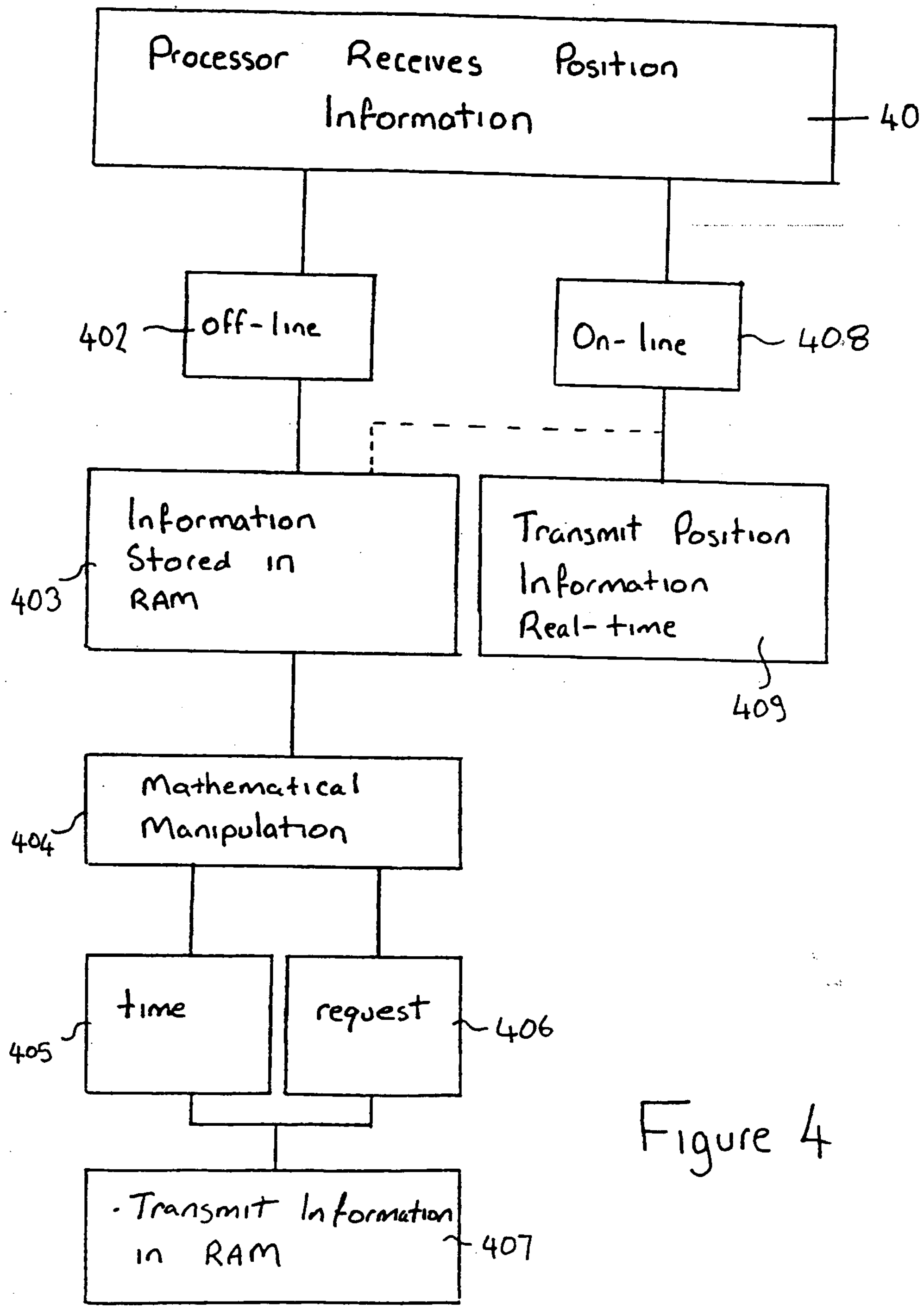
Processor Receives Position Information
401
off-line
402
On-line
408
Information Stored in RAM
403
Transmit Position Information Real-time
409
Mathematical Manipulation
404
time
405
request
406
Transmit Information in RAM
407

Figure 4

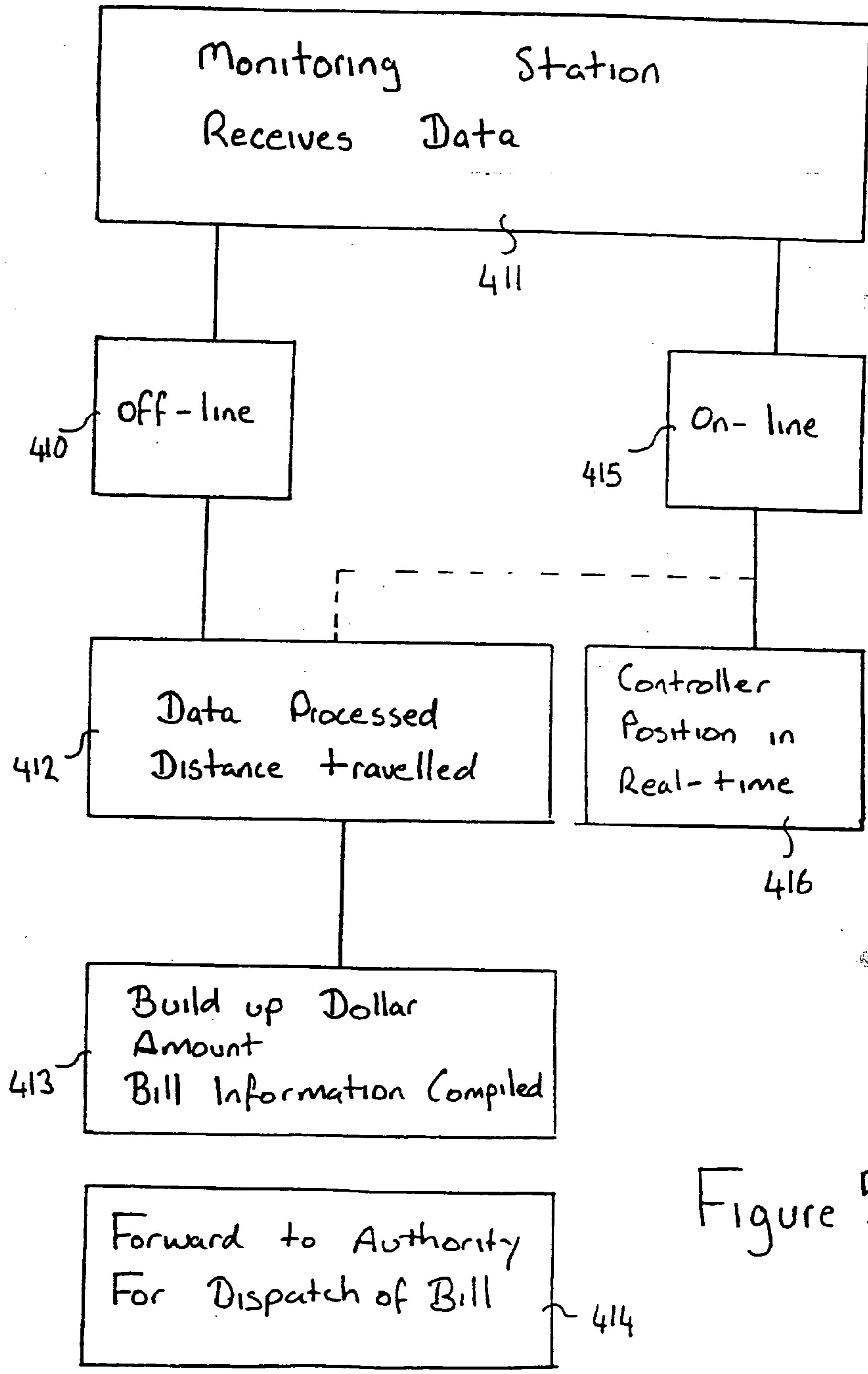
Monitoring Station
Receives Data
411
Off-line
410
On-line
415
Data Processed
Distance travelled
412
Controller
Position in
Real-time
416
Build up Dollar
Amount
Bill Information Compiled
413
Forward to Authority
For Dispatch of Bill
414

Figure 5

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/AU 96/00454

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl⁶: G07B 15/02, G08G 1/123, 1/127, G01C 22/00 22/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC G07B 15/02, G08G 1/123, 1/127, 1/12, G01C 22/00, 22/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, 3848340 A (HAMM) 19 November 1974 col 7, line 3 - col 9, line 23, Figs 15, 33	1, 19
X	AU, 12426/70 (443544) B (SIEMENS AKTIENGESSELLSCHAFT) 16 September 1971 page 2, line 29 - page 4, line 6, page 6, line 29 - page 9 line 6, Fig 1	1, 19
P, X	AU, 17044/95 A (DETEMOBIL DEUTSCHE TELEKOM MOBILNET GMBH), 15 August 1995 Claim 1, Fig 1	1, 19

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 October 1996	31 OCT 1996
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (06) 285 3929	Authorized officer M.E. DIXON Telephone No.: (06) 283 2194

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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P, X	DE, 4427392 A (NEIFER) 8 February 1996 Whole specification	1-24
A	US, 4535334 A (TAGAMI et al) 13 August 1985 Abstract	
A	US, 3846803 A (BORGSTROM), 5 November 1974 Whole specification	
A	GB, 2261977 A (LEONARD), 2 June 1993 Abstract	
P, A	AU, 17045/95 A (DETEMOBIL DEUTSCHE TELEKOM MOBILFUNK GMBH) 15 August 1995 Abstract, Fig 1	
A	AU, 39577/89 A (CHEESMAN) 11 July 1991 Claim 1	
A	AU, 78762/75 (487580) B (KALDUR) 9 September 1976 page 2, line 19 - page 3, line 1	
A	FR, 2492971 A (HONDA GIKEN KOGYO KK) 30 April 1982 Claim 1, Fig 2	
A	DE, 4414395 A (KUHN) 2 November 1995 Abstract	
A	DE, 4309263 A (SCHMIEDER) 29 September 1994 Abstract	
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A	DE 4232171 A (SCHOELLER TRANSPORTAUTOMATION GmbH) 31 March 1994 Abstract	

AUSTRALIAN PATENT OFFICE
SEARCH REPORT

Application No.
AU 96/00454

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	DE, 3242904 A (TELDIX GmbH) 24 May 1984 Abstract	
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No.
PCT/AU 96/00454

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
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AU	17045/95	WO	9520801	NO	963058	DE	4402613
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		US	4535335	US	4663629		
US	4535334	JP	57201284				
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DE	3242904	EP	110171				
DE	3135354	CA	1179040				
EP	359287	JP	2078907	US	5311173		
EP	329405	CA	1327635	JP	1207622	US	5003306

END OF ANNEX